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PROGRESS IN AERONAUTIC RADIO RESEARCH

The development of radio aids to aviation is being forwarded through work of the National Bureau of Standards, which is operating also as the research division of the Aeronautics Branch, Department of Commerce. In recent months improvements have been made in equipment for use with the system of radio range beacons which the department is installing on the airways. Since a beginning has been made in the installation of beacons of the type which operate a visual indicator, a greater need has been felt for an automatic volume control on the receiving set used aboard the airplanes. Such a device has been developed at the bureau. It relieves the pilot entirely of manipulation in the use of the visual indicator of the beacon signals. It can be used to advantage also in receiving aural-type beacon signals. Another application is in connection with the runway localizing beacon for use either at airports or as part of the system of blind-landing aids which is being developed at the bureau. In connection with the automatic volume control, a deflection instrument is used which serves as an approximate distance indicator. Recent experiments have also added a means of indicating when the airplane is directly over the beacon transmitter, so that the landing field location is thus conveniently and directly indicated to the pilot.

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Another device developed at the bureau to facilitate the use of the visual-type range beacon is the "deviometer." (See Technical News Bulletin No. 162, p. 95; October, 1930.) By its use a pilot can follow any chosen course, within limits, on either side of the equisignal line for which the beacon transmitter is adjusted. It is a shunting arrangement which varies the relative current in the coils actuating the two reeds of the reed indicator, and a pointer indicates the number of degrees off the equisignal line for which the deviometer is set. The device has been found useful in experimental flight tests. The bureau recently furnished one to an air transport company for service tests.

As part of the aeronautical radio work at the bureau special attention has been devoted to receiving sets. For receiving both telephone messages and beacon signals aboard an airplane, receiving sets of special design must be employed. They must be so designed as to function under particular conditions of vibration, local interference, small input voltage, high output level required, and special audio-frequency requirements. The basic designs for such sets have been developed at the bureau. It also keeps in touch with commercial developments in aircraft radio receivers by means of laboratory measurements and experimental trials on an airplane. Satisfactory receiving sets are now found to be available commercially.

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ULTRA-VIOLET TRANSMISSION OF SEA SHELLS

What is known as "Philippine window shell" or "mother-of-pearl" is obtained from a mollusk (*Placuna placenta*) and is extensively used for decorative lamp shades. This shell is composed of calcium carbonate, is translucent, and has a light pink color when not weathered.

Several years ago the bureau conducted some tests on the ultra-violet transmission of this material to determine whether it prevented the passage of rays injurious to the eyes. It was found that thin lamina of the material are transparent to light waves as short as 250 millimicrons, but the complete shell, which is 0.6 to 1.5 millimeters in thickness, is too inhomogeneous to transmit rectilinearly in any one direction, an appreciable amount of ultra-violet radiation. Moreover, ordinary incandescent lamps with which such shades were being used, do not emit sufficient ultra-violet radiation to injure the eye.

Recently, the subject has arisen of using these sea shells in the same way as the special window glasses for transmitting ultra-violet solar radiation for healing purposes. An examination was, therefore, made a short time ago of new and of partially weathered material. Measurements were made of the total amounts of wave lengths 290 to 313 millimicrons, diffusely transmitted in all directions, and also rectilinearly through the material, which in this instance was only 0.7 millimeters in thickness.

The integrated ultra-violet, of wave lengths 290 to 313 millimicrons, diffusely transmitted by the new sample was about 14 per cent of the total incident radiation, and about 11 per cent by the sample which had been exposed to the summer sun for 145 days. For samples of average thickness, 1.5 millimeters, these values would be reduced to 3.8 and 3.3 per cent, respectively. This refers to the total amount of ultra-violet transmitted in all directions throughout a room.

Tests were also made with this material placed directly in front of the entrance slit of the spectroscope and it was found that less than 2 per cent of the ultra-violet, at 302 millimicrons, was transmitted rectilinearly. In contrast, it is to be noted that the special window glasses transmit 30 to 70 per cent, and quartz 90 per cent of these rays.

It is, therefore, concluded that while sea shell has the interesting property of transmitting (diffusely) an appreciable amount of ultra-violet radiation, the

total amount transmitted along a straight line is too low, in comparison with the special window glasses, to be effective in ultra-violet-light therapy.

COOPERATIVE RESEARCH WITH AMERICAN DENTAL ASSOCIATION

During the past year the American Dental Association and the bureau have carried through several inlay techniques according to the recommendations of a number of lecturers and manufacturers. No single one of these has been found satisfactory for all requirements of the laboratory. An extremely important problem is now before the bureau and the association; namely, to select from the various techniques those operations or practices which will be most effective in the dentist's laboratory. This is being done through the cooperation of a group of members of the dental profession who are donating their time and efforts in trying, under laboratory conditions, the most promising details of all techniques.

At present the research associates (Drs. N. O. Taylor and G. Paffenbarger), in cooperation with members of the bureau's staff, are testing inlay golds for their physical properties. It is only recently that the profession in general has taken seriously the question of a rating or minimum requirement for these alloys. In fact, many people to-day recognize only karat and color as the standard for their inlay golds. Hardness (a factor in wear or deformation), percentage of elongation (a factor in brittleness, burnishing, or adapting to edges), proportional limit (a factor in safe strength), and fusing point (a factor in all soldering operations) are meaningless to many dentists at the present time. Frequent inquiries, visits to the bureau, requests for lectures before National, State, and local societies, and an increasing correspondence from the profession indicate that this new idea, involving an understanding of the functions of an inlay, will not be long in establishing itself.

The motto "Proper materials properly used" summarizes the ultimate goal of the program at the National Bureau of Standards.

INTERFERENCE MEASUREMENTS IN THE FIRST SPECTRA OF KRYPTON AND XENON

The wave lengths of the stronger arc lines of krypton and xenon have been redetermined at the bureau by the use of Fabry-Perot etalon interferometers. Etalons of 15, 25, and 40 millimeters

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length were used in obtaining the data. Discharge tubes operated so as to emit only the spectrum of the neutral atom of the gas under investigation supplied the radiation. Part of the xenon lines were observed as impurity lines in the radiation from a krypton-filled tube as well as in tubes containing pure xenon only. The secondary standards of neon photographed simultaneously with the krypton and xenon spectrum furnished the comparison. The values of neon wave lengths used were those given by Burns.

Interferometer measurements of a sufficient number of krypton lines have been made to permit fixing the relative values of all the 1s, 2p, and 3p terms to a high degree of precision. The accuracy of the term values is such that the average deviation of calculated term combinations from the observed wave numbers is 1 part in 20,000,000. The corresponding set of terms in the xenon spectrum, except $2p_{1/2}$, were determined also with increased precision from interference measurements. In addition to these, four of the 4p terms have been recalculated. Nearly three-fourths of the combinations permitted by the selection rule have been observed. The exact location of the combinations in the infra-red region not photographically accessible can not be predicted with certainty. Such lines should prove useful wave-length standards for the infra-red region.

With the resolving power employed none of the krypton lines showed hyperfine structure. It is apparent from the extremely small variations of the "constant differences" that the intensities of any unobserved satellites are too low to affect the wave lengths. Five of the xenon lines showed satellites. Further work is contemplated in the examination of the lines of both spectra for hyperfine structure.

The results of this study will be presented in detail in the November number of the Bureau of Standards Journal of Research. Comparisons are made with earlier interferometer measurements. The close agreement of the bureau's results with those of other observers, as well as the small differences between the separate observations, indicate that the wave lengths of the radiation emitted by krypton or xenon are reproducible within the limits set by the probable error of the observations. For the intense green and yellow lines of krypton, for which Perard, at the International Bureau obtained wave lengths 5570.2892 and 2870.9145 Å, the National Bureau of Standards obtains 5570.2890 and 5870.9153 Å.

THERMAL EXPANSION OF SOME SODA-LIME GLASSES

In connection with work on the physical properties of some soda-lime-silica glasses the thermal expansions of 20 glasses have been determined from room temperature to their initial softening temperatures. The compositions vary from approximately 54 to 80 per cent silica, 38 to 12 per cent soda, and 3 to 15 per cent lime. The expansions were measured by the interference method described by Peters and Cragoe, and an effort has been made to evaluate the expansion of these glasses in terms of their lime and soda content. So far attempts at correlation have been confined to the data obtained from room temperature (approximately 30° C.) to the "critical temperature" or that temperature at which the rate of expansion begins to increase.

The expansion of any of the glasses in the series can be computed with a fair degree of accuracy from the following expressions:

$$E_t = K_t [1.35(\text{CaO} + \text{Na}_2\text{O}) - 0.006(\text{CaO} + \text{Na}_2\text{O})^2 - 0.065\text{CaO}]$$

In this expression E is the expansion in microns per centimeter at any temperature t , and the value for K at certain temperatures is as follows:

| | | | | | |
|----------------|------|------|------|------|------|
| $t = 30^\circ$ | 100 | 200 | 300 | 400 | 500 |
| $K_t = 0$ | 0.21 | 0.57 | 1.00 | 1.49 | 2.00 |

Temperatures are expressed in °C. and the lime and soda are expressed as percentages.

It must be borne in mind that the above expressions hold only between room temperature and the "critical temperature."

SOUNDNESS OF LIME

Lime used for the finish coat of plaster sometimes causes a type of failure known as "popping." Small particles of the finish coat expand, disrupting the surface which causes some of the plaster to fall off, leaving a pit or "pop." This is probably caused by the slow hydration of the constituents of the lime. The present method of testing for this type of failure as adopted by the American Society for Testing Materials involves steaming the lime at atmospheric pressure. Since this method did not appear severe enough, it was proposed to subject the lime to steam under pressure. The lime, mixed with enough calcined gypsum to prevent shrinkage, was spread as a thin coat on a porous porcelain base. After standing for an hour, or until the calcined gypsum was set, it was steamed for two hours at a steam pressure of 120 lbs./in.² in an autoclave.

During the steaming the particles hydrate and expand causing "popping" or unsoundness. This method is essentially that described in Technical News Bulletin No. 144 (April, 1929) with the exception that steaming at 120 pounds pressure has been found preferable to the 20 to 25 pounds pressure as reported previously.

In order to compare the two methods, plastered panels were made using lime for the finish coat. Samples of the limes were tested by both methods.

Thirty-three panels were made up and allowed to age. Of the 33 panels, 24 have developed "pops." Twenty-three of them tested unsound on steaming at 120 pounds pressure, whereas only 12 tested unsound by the A. S. T. M. method. The agreement, therefore, appears to be much better for the autoclave method than for the A. S. T. M. method.

DETERIORATION OF PAPER

A summarization of the activities of the Bureau of Standards relative to the causes of paper deterioration was presented by B. W. Scribner at the recent annual meeting of the Pacific coast section of the Technical Association of the Pulp and Paper Industry, at Portland, Oreg.

Considerable progress has been made in measuring the permanence qualities of the current paper-making raw materials and papers. The tests used for this purpose are based primarily on consideration of paper as a cellulose material. Apparently a high degree of cellulosic purity, with a minimum of active chemical components, and sufficient strength for the intended use, are the prime requirements in paper for resistance to deterioration. The tests show that commercial papers are available, made from both rag fibers and wood fibers, which meet such requirements satisfactorily. Systematic collection and testing of old publications has also shown the importance of cellulosic purity, as the papers composed of fibers refined by chemical treatment are generally in good condition, while those containing crude fibers, such as ground wood, are generally badly deteriorated.

Through surveys of library storage conditions it appears that acid pollution of the atmosphere, light, high temperature, dampness, and dust are the leading external deteriorating influences. The effects of light and of atmospheric components on paper and paper-making materials are undergoing further study in the laboratory.

Studies of the relation of the various paper-making materials to permanence

qualities of papers are being made in a practical way by paper-making trials in the bureau's paper mill. This work so far has dealt largely with wood fibers having a high degree of cellulosic purity, and these have given very satisfactory test values. Studies of paper-sizing materials have shown the desirability of limiting so far as possible the amounts of alum and rosin used in rosin sizing the papers. On the contrary, glue and starch used for surface sizing the papers appear to give them added protection against chemical deterioration.

The improvement and standardization of test methods used for determination of alpha cellulose, copper number, and acidity, all of which appear to have an important bearing on permanence, are receiving attention, and progress in this direction is reported.

EFFECT OF DENSITY OF PACKING ON INSULATING MATERIALS

Within the past few years there has been great activity in the field of heat insulation, particularly for dwellings, and a large number of materials have been utilized in the manufacture of insulating products of various kinds. There are numerous other raw materials, now considered more or less waste, which may be equally suitable for this purpose.

Anticipating the need for additional data, a study has been conducted at the bureau of the insulating properties of various fibrous materials. Tests have been made on jute, cotton, flax, wood fiber, bagasse, cornstalk fiber, moss, excelsior, etc. From an insulation standpoint alone, there is practically no choice between the different commercial grades of each material. The waste or poorest grades, therefore, may be commercially available for the manufacture of heat-insulating materials.

Tests were made of each material packed to various densities covering as wide a range as practicable, and it was found that for each fiber there is an optimum density at which the thermal conductivity is a minimum or the insulation value a maximum. Where the only consideration is maximum insulation in a given space, this suggests that the materials should be packed at these optimum densities.

Considerable attention was given to the mechanism of heat flow, and it was found that for a given fibrous material and a given density, the heat conductivity may vary by several hundred per cent, depending entirely on the arrangement of the fibers. The maximum conductivity is obtained when the fibers are

parallel to, and the minimum conductivity when the fibers are perpendicular to the direction of heat flow. The present methods of manufacture of fibrous sheet materials do accomplish to a large extent the orientation of the fibers so that they are most effective for insulation.

At very low densities it was found that the increase in conductivity was primarily due to radiation; air convection plays a very minor part.

This investigation will be fully described in the November number of the Bureau of Standards Journal of Research.

ANNUAL REPORT OF BUREAU OF STANDARDS FOR 1930

The annual report of Dr. George K. Burgess, Director of the Bureau of Standards, to the Secretary of Commerce, covering the fiscal year ended June 30, 1930, will be released on November 18.

One of the most important developments recorded in this report is the realization after many years' effort of the Waidner-Burgess absolute standard of light, which may eventually supplant the carbon lamps now used as standards of candlepower by the various nations. The new standard was described in Technical News Bulletin No. 151, p. 107 (November, 1929). The brightness of the interior of a tube of fused thoria immersed in a bath of pure platinum at its freezing point has been found equal to 58.84 candles per square centimeter. The difficulties attending the actual setting up of this standard have been very great, but they have all been surmounted so that the process has been reduced to one of mere laboratory routine. A recommendation has been made by the bureau that this standard be accepted by the International Committee on Weights and Measures as a new international standard of light.

In the engineering world, an event of great significance was the signing by the President on May 14 of a bill creating a national hydraulic laboratory to be located at the bureau. This laboratory will study fundamental problems of hydraulics, including flow of rivers and open streams, and will test all kinds of hydraulic machines and instruments. A committee to draw up plans for the laboratory has been appointed.

Developments in the radio field require the highest attainable precision in measurements of frequency. By means of a special installation of four quartz oscillators and auxiliary machinery, including automatic photographic apparatus, it is now possible at the bureau

to measure radiofrequency with an error of only about 2 parts in 10,000,000.

To aid the aeronautic industry a special laboratory has been set up at Arlington, Va., in which each new type of commercial airplane engine is subjected to an endurance test for the Aeronautics Branch of the Department of Commerce. Certificates are granted by the department only for those engines which meet the bureau requirements. Three engines can be tested at one time at present, and equipment for a fourth test stand will soon be installed.

The development of radio aids to air navigation is briefly touched upon. These have been described in recent numbers of this Bulletin. Methods of lighting the airways and landing fields have also been studied, and many tests have been made on the special light alloys used in constructing airplanes and airships. To determine the effect of repeated vibration on duralumin a special machine is in use in which the specimen is floated on air and is caused to vibrate by a high-speed air stream at a rate of 210 cycles per second. Through the use of this machine it is possible to carry tests to 200,000,000 cycles or over.

Through an extensive cooperative investigation on the properties of railroad rails during the period of fabrication it has been found that owing to the low ductility of certain kinds of steel at the temperatures at which rails are rolled there is a tendency for the formation of nuclei within the rails from which transverse fissures may later develop in service. Certain changes in the manufacturing procedure are suggested as a means of correcting the evil.

Experiments on the tanning of sole leather have shown that chrome-tanned leather retanned with vegetable material will wear from 25 to 27 per cent longer than ordinary vegetable-tanned leather. The effect of sulphuric acid on leather and paper has been studied and it has been shown that acid in amounts commonly present in the atmosphere of large cities has a very serious deteriorating effect.

The importance of using thoroughly purified fibers in paper intended for permanent records has been brought out. A study of old newspapers has shown that with the substitution of raw wood pulp for the more highly purified materials a marked decrease in the permanence of the paper took place. Many papers issued 30 or 40 years ago have almost completely deteriorated. In the semicommercial plant maintained by the National Bureau of Standards and Iowa State College at Ames, Iowa, wall board one-half inch thick and twice as strong

as any on the market has been produced from cornstalks. The process is now being used commercially.

Xylose has been successfully manufactured in an experimental plant at Aniston, Ala., and possible uses for this new sugar are being studied.

The experimental sugar refinery at the bureau has been operated on the first stage of the process of producing levulose from Jerusalem artichokes, and the next step, the actual crystallization of the sugar from its water solution will be undertaken very shortly.

Under the auspices of the American Society for Testing Materials a cement reference laboratory has been established at the bureau to standardize testing procedure and methods in the numerous cement laboratories throughout the country. (See Technical News Bulletins Nos. 145, 150, 151, 154, and 156.) Inspection trips are made by the personnel of this laboratory and their services have been in constant demand.

In the field of optics progress is recorded on the mapping of spectral lines and in particular in search for a new and better fundamental standard of wave length. A series of filters has been developed by which the character of artificial light sources can be changed to that of sunlight, and one of these has been recommended for adoption as an international standard by the Seventh International Congress on Photography.

A continued investigation on which progress is recorded deals with the development of methods for the fractionation of petroleum and the identification of its constituent hydrocarbons. This work involves laboratory technique of extreme difficulty, but good progress has been made and several publications issued.

In cooperation with the American Petroleum Institute, the American Gas Association, the Underground Pipe Products Institute, and the Cast Iron Pipe Research Institute, a beginning has been made of an extensive field investigation of protective coatings for underground pipe lines. This work supplements similar work which has been in progress for several years on the corrosive effect of soils on underground pipe.

The investigation which the bureau has been conducting in cooperation with the American Society of Mechanical Engineers and other organizations on the determination of the properties of steam has formed the basis for a revision of the steam tables by international conferences in London and Berlin.

The Post Office Department is a branch of the Government which is mak-

ing increasing use of the bureau's facilities. Considerable time has been spent in studies of automatic machines which have been proposed to the department for adoption in its mechanization program. Among these were mail meters, where safeguards against fraud are of importance.

During the period under consideration an interesting extension of the bureau's simplified practice work has taken place. In the past this has been confined almost entirely to production, but recently simplified practice methods have been extended in the fields of distribution and consumption and important progress is being made on the simplification of containers and packing methods. Satisfactory progress is also recorded in the fields of specifications and commercial standards, standards having been adopted for a wide range of products from dress patterns to fuel oils.

The division of building and housing has cooperated with the new construction division of the department on many problems connected with the Government's program of public construction.

The number of tests completed by the bureau during the year was 200,726 with a fee value of \$683,614, a substantial increase over last year, when the figures were 173,512 and \$544,402. One hundred and ninety-four papers were published in the regular series of the bureau and about 240 in outside journals.

ENCYCLOPEDIA OF STANDARDS AND SPECIFICATIONS FOR NONMETALLIC MINERALS AND THEIR PRODUCTS

The second volume of the bureau's encyclopedia series, entitled "Standards and Specifications for Nonmetallic Minerals and Their Products," has just been released. The first publication of the series covering "Standards and Specifications in the Wood Using Industries" appeared in 1927.

The current volume can be described as an editorial compendium. An effort has been made to include in full, or by means of adequate abstracts, tabulations, or cross references, every available nationally recognized specification, standard of practice, or simplification project dealing with nonmetallic minerals or products thereof.

To bring the compilation into being, three major steps were involved.

The first step was in determining what material, from the mass available, should be used. In line with the procedure already adopted for the encyclopedia series, it was decided to include standards of nationally recognized organiza-

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tions qualified to speak for industry and units authorized to represent the Federal Government as a whole. This plan qualified as contributors trade associations and technical societies nationally representative, as well as governmental agencies whose edicts control practically completely the Government's acts within their prescribed fields. The volume thus becomes an utterance of industry and the National Government.

The second major step was the making of a survey of the field thus prescribed, to determine the extent of standardization and the nature and quality of the material available. The volume reflects the nature and extent of the work done in the field of nonmetallic minerals, and directs attention to subjects awaiting development in standardization and simplification.

The third major step was in arranging the material for presentation. The volume, of course, is self-expressive as to this step.

Perhaps the most conspicuous feature in the utilization of the fruits of research and work of over 70 organizations was the whole-hearted cooperation given by all of the agencies whose products were included in the volume. Not only was there a general willingness to permit publication, or republication, of the many choice products of technical committee work, but further aid was given in checking over the material in manuscript form and suggesting methods of arrangement.

For many of the commodities included there are several separate specifications, and logically, there is considerable overlapping in the separate texts. In this volume duplication is avoided by the use of an extensive reference system. It should be mentioned that in using these references no preference of the standards of one organization over those of another is intended, the idea being simply to avoid unnecessary duplication in presentation.

To permit the reader to take advantage of later revisions of the specifications reprinted, the volume includes a list of names and addresses of organizations the standards and specifications of which are reproduced.

The order of arrangement follows the decimal system of classification as employed in the National Directory of Commodity Specifications. Under this commodity classification system the material is made readily available for the use of architects, contractors, lay purchasers—anyone, in fact, having occasion to make use of nationally recognized specificational data.

Copies of this publication (Miscellaneous No. 110) may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at \$2.75 each.

CERTIFICATION OF LUMBER AND BRICK

The lists of willing-to-certify manufacturers and wholesale lumber dealers now contain the names of over 1,900 firms. According to present plans these lists will be placed in mimeograph form and distributed to all known retail lumber dealers, numbering in excess of 12,000.

More than 60 per cent of the 48 known manufacturers of sand-lime brick have expressed their desire to supply brick guaranteed by them to comply with Federal specification No. 505. Nearly 400 manufacturers of common clay brick have stated that they are willing to certify to compliance with all of the requirements of Federal specification No. 504. The survey of the brick industry has developed the fact that under certain conditions in certain localities common clay brick somewhat larger or somewhat smaller than the standard size are considered satisfactory, provided they comply with the specification requirements relating to strength and absorption. Arrangements have been made to list sources of supply of both standard size and nonstandard size bricks which meet the strength and absorption requirements.

CONSTRUCTION ACTIVITY DURING AUGUST, 1930

The value of construction contracts awarded in 37 States during August, 1930, as reported by the F. W. Dodge Corporation, was \$347,318,300, a decrease of 5.5 per cent as compared with the preceding month and 29 per cent as compared with August, 1929. This figure brought the total value of contracts awarded for the first eight months of this year to \$3,352,485,000, a decrease of 19.4 per cent as compared with the same period of 1929, when contracts let amounted to \$4,156,865,300.

Construction of public works and public utilities continues at a high rate, with contracts during the first eight months of 1930 showing an increase of 17 per cent over the same period of 1929. Residential building, however, continues to lag behind last year, a decrease of 47.9 per cent being noted for this class. Of those classes of construction which are classified with nonresidential building, hospitals and institutions, and public buildings increased 38.2 and 13.4 per cent, respectively.

NEW AND REVISED PUBLICATIONS
ISSUED DURING OCTOBER, 1930Journal of Research¹

Bureau of Standards Journal of Research, Title page and index to volume 4, January to June, 1930 (RP Nos. 129 to 182, inclusive). Free on application to the Bureau of Standards.

Research Papers¹

(Reprints from Journal of Research)

- RP194. Fire clays; some fundamental properties at several temperatures; R. A. Heindl and W. L. Pendergast. Price, 10 cents.
- RP195. A precise and rapid method of measuring frequencies from 5 to 200 cycles per second; N. P. Case. Price, 5 cents.
- RP196. Coefficient of friction of fabrics; A. A. Mercier. Price, 5 cents.
- RP197. Accelerated tests of asphalts; O. G. Strieter. Price, 10 cents.
- RP198. Conductivity and density of chromic acid solutions; H. R. Moore and W. Blum. Price, 5 cents.
- RP199. Preliminary studies of the effect of deoxidation and mold conditions on the tensile properties of carbon steel castings; J. V. McCrae and R. L. Dowdell. Price, 5 cents.
- RP200. The precipitation and ignition of magnesium and ammonium phosphate; J. I. Hoffman and G. E. F. Lundell. Price, 5 cents.
- RP201. A new design of precision resistance standard; J. L. Thomas. Price, 5 cents.
- RP202. The structure of the spectra of doubly and trebly ionized zirconium; C. C. Kiess and R. J. Lang. Price, 10 cents.
- RP203. Phase equilibria in the system $\text{Cr}_2\text{O}_3\text{-SiO}_2$. Price, 5 cents.
- RP204. A method of measuring frictional coefficients of walkway materials; R. B. Hunter. Price, 10 cents.
- RP205. Bearing bronzes with additions of zinc, phosphorus, nickel, and antimony; E. M. Staples, R. L. Dowdell, and C. E. Eggenschwiler. Price, 15 cents.
- RP206. Cutting tests with cemented tungsten carbide lathe tools; T. G. Digges. Price, 10 cents.

RP207. Heat transfer through metal-enclosed insulation; by M. S. Van Dusen. Price, 5 cents.

RP208. Effects of gases on photo-ionization of caesium by line absorption; F. L. Mohler and C. Boeckner. Price, 5 cents.

RP209. A calorimetric determination of thermal properties of saturated water and steam from 0° to 270° C.; N. S. Osborne, H. F. Stimson, and E. F. Flock. Price, 20 cents.

RP210. A review of calorimetric measurements on thermal properties of saturated water and steam; E. F. Flock. Price, 10 cents.

Circulars¹

C383. Washing, cleaning, and polishing materials. Price, 10 cents.

Simplified Practice Recommendations¹

R31-30 (4th ed.). Loaded paper shot shells. Price, 5 cents.

R112-29. Elastic shoe goring. Price, 5 cents.

Commercial Standards¹

SC24-30. American national standard screw threads (coarse and fine thread series). Price, 10 cents.

CS25-30. American national special screw threads. Price, 15 cents.

Miscellaneous Publications¹

M110. Standards and specifications for nonmetallic minerals and their products, 1930. (Cloth bound; 680 pages.) Price, \$2.75 (foreign, \$3.05).

M113. Simplification of sizes and terminology of high volatile bituminous coal (handled over docks at American head of the Great Lakes). Price, 5 cents.

Commercial Standards Monthly¹

Commercial Standards Monthly, vol. 7, No. 4, October, 1930. Obtainable by subscription. (See footnote.)

Technical News Bulletin¹

TNB163. Technical News Bulletin, November, 1930. Obtainable by subscription. (See footnote.)

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